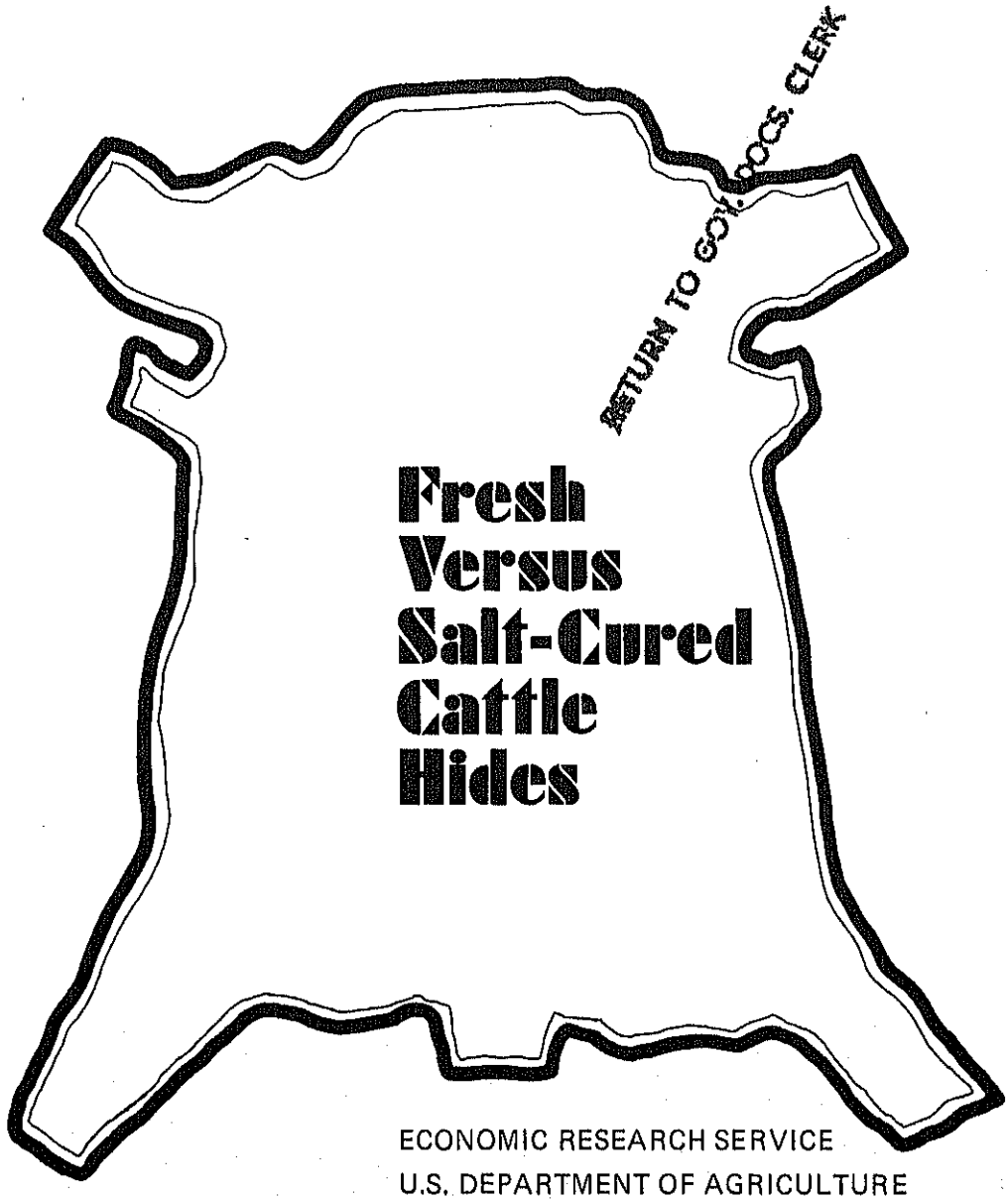
MARKETING RESEARCH REPORT NO. 1032

TANNERY COSTS:



Fresh Versus Salt-Cured Cattle Hides

ECONOMIC RESEARCH SERVICE
U.S. DEPARTMENT OF AGRICULTURE

ABSTRACT

Earnings of a model side-upper tannery are estimated to be increased by $2.07 per hide when fresh cattle hides replace salt-cured hides as the raw material input. Fresh hides reduce processing time in beamhouse operations, saving the equivalent of 53 cents per hide. In tannage--from beaming through paste-plate drying to crust leather--the greater yield of fresh over salt-cured hides (3 percent) adds another 22-cent savings. The largest potential increase in earnings ($1.32 per hide) results from sales of more leather (3 percent increase in yield) per hide.

Research by USDA's Agricultural Research Service and Economic Research Service on reducing tannery wastes and pollution costs shows that fresh hide processing has the potential for meeting added waste treatment costs. Pollution waste treatment costs used in the model tannery can be offset by the cost savings and increased revenues resulting from the shift to processing fresh instead of salt-cured cattle hides.

Keywords: Tanning costs, Cattle hides, Leather tanning, Pollution control costs.

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SUMMARY

Using fresh instead of salt-cured cattle hides as a raw material input to a model side-upper tannery can potentially increase earnings by $2.07 per hide (4.2 cents per pound) through cost savings and increased revenues from tanning operations. Cost benefits are found in the wet-end operations, beaming to crust operations, and marketing operations.

The major advantage of processing fresh instead of salt-cured hides in the beaming operations is a savings in processing time. In the study model, total beamhouse processing time for fresh hide is 52 hours, compared with 61 hours for salt-cured hide. The 9-hour (14.8 percent) reduction in beamhouse operating time with fresh hides represents a savings of 53 cents per hide.

Tanning operations from beaming to crust for fresh and salt-cured cattle hides are the same. However, yields for fresh hide processed through a paste-plate drying operation averaged 3 percent greater than yields of salt-cured hide. This increase in effect reduces tanning costs by 22 cents per hide.

Sales revenues can be significantly affected by raw material input. The 3 percent higher yield per fresh hide means that fresh hide sells for $1.32 per hide more than salt-cured hide.

Adding pollution control facilities to the model plant raised total costs by $1.99 per hide processed. Facilities were assumed to consist of an activated sludge waste treatment operation costing $747,187 in 1973. Since the combined cost savings and increased revenue resulting from a shift from salt-cured to fresh hide processing in the plant model was $2.07 per hide, a shift to fresh hide could offset the cost of pollution control facilities and offer an increase in gross profit potential of 8 cents per hide.

TANNERY COSTS:

Fresh Versus Salt-Cured Cattle Hides

by

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INTRODUCTION

Processing and tanning cattle hides is a major U.S. livestock byproduct industry. Since 1970, nearly 37 million salt-cured cattle hides (about 1.35 million tons, fresh weight) have been sold annually--about 17 million as exports and 20 million to the domestic tanning industry. Sales for tanning and exports generate almost $1 billion in gross revenues to cattle-slaughtering operations. 1/

USDA's Economic Research Service and Agricultural Research Service, in cooperation with cattle hide processors and tanners, have been studying the elimination of salt in hide curing as a possible means of reducing water pollution from cattle hide tanning. This research has yielded reports concerning:

(1) Necessary industry structural changes. 2/

(2) Physical and chemical properties of leather made from fresh and salt-cured hides. 3/

(3) Storage capabilities of blue, chrome-tanned leather. 4/

(4) New chemical treatment to lengthen storage life of fresh hides. 5/

1/U.S. Department of Commerce and Tanners Council statistics.

2/Poats, F.J. and Naghski, J. Alternatives for Reducing Water Pollution in Cattlehide Processing and Tanning, ERS-537, U.S. Dept. Agr., Econ. Res. Serv., Nov. 1973, 6 pp.

3/Feairheller, S.H., and others. A Matched-Side Study of the Leather Made from Fresh and Salt-Cured Hides, Technical paper to 70th ann. mtg., Amer. Leather Chemists Assoc. Pocono Manor, Pa., June 19, 1974.

4/Ibid.

5/Hopkins, W.J., Bailey, D.G., Weaver, E.A., and Korn, A.H. Potential Short-Term Techniques for the Preservation of Cattlehides, Jour. of Amer. Leather Chemists Assoc., Vol. LXVIII, No. 10, Oct. 1973. Reprint, 11 pp.

(5) Productivity increases and cost savings generated in hide processing and tanning facilities as a result of discontinuing the salt-curing procedure. 6/

A recent study provided technical and economic information used in this report. Tests on 300 cattle hides showed that little or no difference existed between test lots of fresh and salt-cured hides when sampled as blue-chrome stock or crust-leather stock. 7/ In all but one of the tests, differences between leathers were statistically insignificant. The shrinkage temperature tests on tanned hide showed a significant difference in favor of fresh hide. Processing differences were found which could be used to advantage when processing fresh hides. Also, there were indications that tanning fresh hides would result in a higher area yield of crust leather. The study found that leather made from fresh hide was at least as good as, if not better than, leather made from salt-cured hide.

This research was aimed at determining how costs of converting salt-cured cattle hide to leather compare with costs for processing fresh cattle hide to leather. Costs of tanning both salt-cured and fresh cattle hide to crust leather (fully tanned side-upper leather, ready for surface finish to be applied) are analyzed using the economic-engineering model method.

Processing and capital equipment costs are based on information from published reports and discussions with tannery personnel and equipment manufacturers. The developed costs do not represent a specific plant or company's operation. They are, however, considered attainable for a facility operating under normal conditions. All cost estimates are optimal costs and presented on the basis of a model plant operating under specified conditions at a specific time. They may or may not correspond to current tannery operating costs.

Table 1 shows the sequence by which salt-cured cattle hides are converted into finished leather (col. 1). Columns 2 and 3 show the processing required for taking cattle hide through blue-chrome tannage and then processing into leather (alternative I) and the step-by-step processing of cattle hide through crust leather and finally to finished leather (alternative II). Column 4 shows the model tannery processing cost functions.

Alternatives I and II illustrate two ways in which the industry structure might be changed if fresh cattle hides replace salt-cured hides as the raw material input in the leather making and finishing process. Although direct cost structures for these two alternatives are not presented, they can be approximated by taking the departments and operations shown in table 1 and using the departmental cost figures shown in table 6. The model tannery, for the most part, presents alternative II costs--which exclude the additional marketing and administrative overhead expenses of selling crust leather--as well

6/Poats, F.J. Some Economic Consideration for Marketing U.S. Cattlehides, Speech, 23rd ann. symp., Tanner's Production Club of Wisconsin, Milwaukee, Wis., U.S. Dept. Agr., Econ. Res. Serv., Mar. 9, 1974.

7/See reference cited in footnote 3.

Table 1--Sequence of present and alternative cattle hide-to-leather processing

Processing and marketing functions	Present industry practice	Leather product: Alternative I (blue chrome)	Leather product: Alternative II (crust)	Model tannery
Buy fresh hides (hide processor)	X	X	X	
Hidehouse				
Wash, demanure, flesh, trim	X	X	X	
Brine cure	X			
Wring	X			
Class, weigh, tie, palletize	X	Near source of fresh cattle hides		
Store	X			
Sell salted hides	X			
Buy hides (tannery)	X			
Hideroom				
Receive, store, sort, retrim	X			X
Side	X 1/			
Beamhouse				
Soak, wash, dehair, bate	X	X	X	X
Sort, retrim, split	X 1/	X 1/	X 1/	
Relime, bate, pickle, chrome-tan	X	X	X	X
Wring and setout	X	X	X	X
Blue sort	X	X	X	X 1/
Side	X 1/		X 1/	X
Pallet, wrap, store		X		
Sell blue, chrome-tanned leather		X		
Buy blue, chrome-tanned leather (tannery)		X		
Receive, store		X		
Laboratory analysis		X		
Wring and setout		X		
Side and retrim		X		
Blue sort		X		X 1/
Split and shave	X 1/	X 1/	X 1/	X
Tan and dyehouse				
Retan, dye, fat-liquor	X	X	X	X
Setout and paste dry	X	X	X	X
Take-off, stack, condition	X	X	X	X
Stake	X	X	X	X
Buff	X	X	X 1/	X
Crust sort	X	X	X	X
Measure, pack, mark, store			X	X
Sell crust leather			X	
Buy crust leather (finisher or leather goods manufacturer)				
Receive, measure, sort, store			X	
Buff			X 1/	
Finishing				
Color and plate	X	X	X	
Sort and measure	X	X	X	
Pack, mark, store	X	X	X	
Sell leather	X	X	X	

1/Optional at this point.

as the difference accruing to tanneries by shifting to fresh cattle hide as an input material.

ASSUMPTIONS USED FOR THE MODEL TANNERY

Processing costs by function for the model tannery (table 1, col. 4) are based on the following assumptions:

1. The tannery receives and processes 1,500 hides (3,000 sides) each day. Processing includes converting the hide into crust leather.

2. The plant operates for 250 days per year. All employees do not start and stop work at the same time in any one working day. There are 7 hours 15 minutes of actual production time per 8-hour shift. The remaining paid time includes two 15-minute breaks and 15 minutes for equipment down-time. A 30-minute lunch period is not paid time.

3. Annual plant production is 375,000 hides (750,000 sides). Annual paid hours per employee total 2,000 and actual production hours, 1,812.5.

4. Average weight of a hide received at the tannery for processing into leather is 50 pounds for a salt-cured hide (salt pack or brine) and 60 pounds for a fresh hide. Both types of hides are trimmed, fleshed, and demanured in accordance with specifications in the Tanners Hide Bureau publication, "Trade Practice for Proper Cattlehide Delivery." Also, hide quality and all other characteristics are identical for fresh and salt-cured hides.

5. The tanning facilities and equipment are housed in a steel-fabricated building containing 65,000 square feet of space. The structure costs an estimated $18.00 per square foot and has a useful life of 40 years and an estimated salvage value of $50,000.

6. The tanning process requires 8.0 gallons of water per pound of salt-cured or fresh hide or 400 gallons per hide. Cost of water is $0.18 per 100 cubic feet. Usage by major operations in relation to total consumption is as follows:

Item	Percent
Beamhouse operations	71
Retan, color, and fat-liquor operations	29
	100

7. Waste effluent totals 7.0 gallons per pound of salt-cured hide processed, or 525,000 gallons of waste effluent daily. The same volume is estimated for fresh hide processing. Sewage charges are $0.18 per 100 cubic feet of waste effluent. The effluent flow by major operation is the same as shown in item 6 for water usage.

8. The cost of 1,000 BTU's of steam, including cost of fuel, water, and boiler supervision, is 0.22 cents. Steam power required for processing is as follows:

a.	Through blue-tanning	56,500	BTU's/hide
b.	From blue through crust leather	286,600	BTU's/hide
c.	From crust through finished leather	21,900	BTU's/hide
	Total	365,000	BTU's/hide

9. Electric power required to process one hide through crust leather is 5.17 kilowatt-hours (kWh) at 3.6 cents per kWh. Electric power required by the processing operations is as follows:

a.	Through blue-tanning only	0.85 kWh/hide.
b.	From blue through crust	4.32 kWh/hide.

10. Chemical costs are $1.75 per side or $3.50 per hide and are consumed in the following proportions by the major departments:

Department	Percent
Beamhouse	27.5
Color, retan, and fat-liquor	71.0
Pasting	1.5
Total	100.0

THE MODEL

The model tannery design used in this analysis includes all departments usually found in an operating tannery except the finishing department. This department is not included since any changes in marketing leather either in the blue-chrome or crust state would have little if any impact on this department's operation.

Table 2 shows the major departments included in the model operation and the estimated amount of space required.

Table 2--Major departments and estimated floor space required for model tannery

Department	Estimated floor space required	Percent of total floor space
	Square feet	Percent
Hide receiving and storage	6,500	10.0
Beamhouse	16,250	25.0
Blue sort	1,625	2.5
Split and shave	3,250	5.0
Retan, color, and fat-liquor	16,250	25.0
Setout and pasting	9,750	15.0
Staking	3,250	5.0
Crust sorting	1,625	2.5
Storage, packing, and shipping	6,500	10.0
Total	65,000	100.0

Space allocations to specific operational functions in this model may or may not be directly comparable to a specific tannery's operations. The allocations are based primarily on the sizes and quantities of the processing equipment used in this study. No space has been allocated in the model for administrative functions or for such purposes as parking areas, exterior shipping and receiving platforms, or rail sidings.

CAPITAL EQUIPMENT AND DEPRECIATION

Total equipment cost, based on the use of all new equipment in the model plant, is estimated at $1,911,114. All equipment costs include delivery and installation at plant site as of October or November 1973. On a project this size, competitive bidding by equipment suppliers would undoubtedly provide somewhat different equipment cost figures for a specific department. However, these figures are based on equipment suppliers' catalog list prices and include no quantity discounts.

Table 3 lists the equipment required for the model plant and its estimated cost, salvage value, and annual depreciation expense by major operating departments. Most equipment was depreciated over a 10-year period using the straight-line method of depreciation. However, forklift trucks were depreciated over a 6-year period, wood pallets over 3 years, and both high and low wooden horses over 5 years.

Labor Costs

Table 4 shows the number of personnel required by classification and hourly wage costs for each major department. These wage costs include social security taxes and all other fringe allowances.

These figures are estimates and may or may not reflect either the proper classification or hourly salary rate for a specific plant. These classifications and rates are, however, believed to be representative of existing plant classifications and wage rates for tasks performed by the classifications shown in the table. The hourly wage rates are based on 5-cent brackets and, as the difficulty of a specific classification is upgraded, the wage rate is increased by 5 cents or more per hour.

Overhead Costs

In this study, overhead costs include taxes, interest, and insurance.

Taxes

Property taxes were estimated by using 55 percent of the book value of the tannery equipment and building as the appraised value for tax purposes. The tax rate was 4 percent of the appraised value. In this model, annual property tax is $67,784.51 or $0.18 per processed hide and was computed as follows:

›uilding cost (65,000 sq.ft. x $18.00/sq.ft.)	$1,170,000.00
›quipment cost (table 3)	1,911,114.00
ling and equipment cost	3,081,114.00
appraised value (55% of total)	1,694,612.70
annual property tax (4% of appraised value)	67,784.51

Table 3--Estimated capital equipment used in tannery processing 1,500 hides per day through crust leather, 1973

Department and equipment required	Quantity required	Estimated total cost	Estimated salvage value	Estimated annual depreciation
	Number	Dollars		
Hide receiving and storage				
Forklift (propane fuel)	1	11,000	500	1,750
Scale (platform type, 6,000 lb. dial, with tape recorder)	1	3,702	370	333
Pallets (wood)	300	1,500	0	500
Department total	--	16,202	870	2,583
Beamhouse				
Fleshing and demanuring machine including demanuring cylinder (10½ ft. long)	1	54,810	5,000	4,981
Tanning drum 10 x 10 with variable speed drive, electronic controls, valves, meters and pumps	2	84,900	8,000	7,690
Tanning drum 10 x 10 with 3-speed drive, electronic controls, valves, meters and pumps	18	689,400	60,000	62,940
Hide wringer (10½ ft. long)	4	105,280	10,528	9,475
Siding machine rubber belt with drive--12" rotating knife, pneumatic operation (18' long x 6' wide)	1	6,000	600	540
Forklift (propane fuel)	1	11,000	500	1,750
Pallets (wood)	180	900	0	300
Department total	--	952,290	84,628	87,676
Blue sort				
Measuring machine (electronically measures weight--i.e., thickness and surface area)	1	18,820	1,500	1,732
Forklift (propane fuel)	1	11,000	500	1,750
Pallets (wood)	300	1,500	0	300
Department total	--	31,320	2,000	3,782
Split and shave				
Side splitting machine (63")	3	162,000	16,200	14,580
Side shaving machine (50")	4	78,800	7,000	7,180
Pallets (wood)	300	1,500	0	500
Department total	--	242,300	23,200	22,260
Retan, color, and fat-liquor				
Color drum 10 x 10 with variable speed drive, electronic controls, valves, meters and pumps	1	42,450	4,000	3,845
Color drum 10 x 10 with 3-speed drive, electronic controls, valves, meters and pumps	5	191,500	19,000	17,250
Horses (low-type wood with stainless steel hardware, 50-80 hide capacity)	25	3,500	300	640
Department total	--	237,450	23,300	21,735

Continued

Table 3--Estimated capital equipment used in tannery processing 1,500 hides per day through crust leather, 1973--Continued

Department and equipment required	Quantity required	Estimated total cost	Estimated salvage value	Estimated annual depreciation
	Number	Dollars		
Setout and pasting				
Setout machine (double set--125 sides/hour)	4	59,200	6,000	5,320
Paste-plate dryer system complete (including paste sprayer, dryer, boards, takeoff table, washing and conditioning machine--250 boards per shift operating rates) and skin washer	1	180,000	18,000	16,200
Pallets (wood)	300	1,500	0	500
Department total	--	240,700	24,000	22,020
Staking				
Staking machines--5' including auto-stake attach (150-300 sides/hr)	3	88,500	8,850	7,965
Brushing machine 1/	2	19,200	1,900	1,730
Stackers (automatic)	2	13,700	1,300	1,240
Dryer (vacuum type)	1	19,200	1,900	1,730
Horses (high-type wood, 50-80 hide capacity)	50	5,000	500	900
Department total	--	145,600	14,450	13,565
Crust sort				
Sorting table-belt conveyor (5' wide x 15' long complete with drive)	1	3,000	300	270
Measuring machine complete with accessories	1	21,950	2,000	1,995
Table (wood)	1	100	0	10
Horses (high-type)	50	5,000	300	940
Department total	--	30,050	2,600	3,215
Storage, packing, and shipping				
Scale (60# dial)	1	400	50	35
Scale, platform type with recorder, 6000# dial	1	3,702	300	330
Wrapping table	1	100	0	10
Forklift (propane fuel)	1	11,000	500	1,750
Department total	--	15,202	850	2,125
Tannery total	--	1,911,114	175,898	178,961

1/Fleshside buffing only; buffing for sueded and corrected-grain finishes is done after crust sort by the finishing department.

Table 4--Personnel classifications and estimated total wage cost used for model tannery facilities, 1973

Department and personnel classification	Estimated hourly rate 1/	Personnel	Total personnel cost
	Dollars	Number	Dollars/hour
Hide receiving and storage			
Supervisory clerk	5.15	1	5.15
Forklift operator	5.10	2	10.20
Laborer	5.05	2	10.10
Department total	--	5	25.45
Beamhouse 2/			
Supervisor (dept.)	5.40	1	5.40
Machine operator	5.25	8	42.00
Semi-skilled laborer	5.10	10	51.00
Laborer	5.05	6	30.30
Forklift operator	5.10	1	5.10
Department total	--	26	133.80
Blue sort			
Grader-supervisor	5.30	1	5.30
Laborer	5.05	5	25.25
Department total	--	6	30.55
Split and shave			
Supervisor (dept.)	5.40	1	5.40
Machine operator	5.25	10	52.50
Department total	--	11	57.90
Retan, color, and fat-liquor 2/			
Supervisor (dept.)	5.40	1	5.40
Semi-skilled laborer	5.10	5	25.50
Laborer	5.05	2	10.10
Department total	--	8	41.00
Setout and pasting 2/			
Supervisor (dept.)	5.40	1	5.40
Machine operator	5.25	8	42.00
Paster	5.20	6	31.20
Takeoff man	5.10	3	15.30
Laborer	5.05	3	15.15
Department total	--	21	109.05
Staking			
Supervisor (dept.)	5.40	1	5.40
Machine operator	5.25	5	26.25
Laborer	5.05	2	10.10
Department total	--	8	41.75
Crust sort			
Supervisor (dept.)	5.40	1	5.40
Sorter	5.25	2	10.50
Semi-skilled laborer	5.10	4	20.40
Laborer	5.05	1	5.05
Department total	--	8	41.35

Continued

Table 4--Personnel classifications and estimated total wage cost used for model tannery facilities, 1973--Continued

Department and personnel classification	Estimated hourly rate 1/	Personnel	Total personnel cost
	Dollars	Number	Dollars/hour
Storage, packing, and shipping			
Shipping clerk	5.15	1	5.15
Semi-skilled laborer	5.10	1	5.10
Laborer	5.05	2	10.10
Department total	--	4	20.35
Tannery total	--	97	501.20

1/ Includes allowances for fringe benefits.
2/ Includes more than one shift operation.

Interest

The midlife value of the building and major items was used to calculate annual interest costs. All equipment was considered as a major item except forklift trucks, wood pallets, tables, and wooden horses. The general formula--item value less salvage value, divided by two--was used to determine the midlife value. Money was assumed to be available at a 10-percent interest rate. The estimated annual interest expense for the model operation is $142,535.80 or $0.38 per hide.

Insurance

This includes costs for fire and boiler insurance. An estimated rate of $0.36 per $100 valuation and 80 percent of the value of all equipment and buildings was used in computing the annual fire insurance rate. This amounts to $8,859.21 per year or $0.02 per hide. The boiler insurance premium used for the model was $250 per year.

Variable Costs

Variable costs used in this report include electricity, water and sewage, power, and repairs and maintenance (table 5).

Table 5--Estimated annual variable costs for tannery processing 1,500 hides per day through crust leather, 1973

Item	Estimated expenses	Percent of total variable cost
	Dollars	Percent
Electricity	69,795.00	22.9
Water	36,096.26	11.8
Sewage	31,584.22	10.3
Fuel	52,500.00	17.2
Power (steam)	105,000.00	34.4
Repairs and maintenance	10,302.55	3.4
Total	305,278.03	100.0

Electricity

Electric power required to process one hide is assumed to be 5.17 kWh and the charge per kWh is $0.036. These electric consumption and cost rates include only the plant processing requirements. Total estimated annual expense for electric power is $69,795.

Water and Sewage

Water and sewage charges are based on the pounds of hide, either fresh or cured, put into the tanning process. The cost of water is $0.18 per 100 cubic feet. Eight gallons are required to process each pound of salt-cured hide and

8.0 gallons are required per pound of fresh hide. Annual water expense for processing salt-cured hides only is estimated to be $36,096.26 based on 7.48 gallons per cubic foot.

Sewage charges are $0.18 per 100 cubic feet of effluent. Seven gallons of effluent are produced per pound of hide processed. On this basis, annual sewage charges are estimated to be $31,584.22 for the model plant.

Fuel

It is assumed that a gas-fired boiler provides the steam required for processing. The fuel cost is $0.40 per 1,000 cubic feet of gas used. It is assumed that 1,000 cubic feet of gas supply 994,700 BTU's. Processing a hide through crust requires 343,100 BTU's. Thus, it takes 340 cubic feet of gas at a total cost of $0.14 to provide enough steam to process a single hide. Annually, the cost for fuel would be $52,500.

Power (steam)

Total cost of making steam, including the cost of fuel, is estimated to be $0.42 per hide. Excluding the fuel cost this figure would be $0.28 per hide or $0.0008 per 1,000 BTU's. This includes only the cost of water to make the steam and boiler supervision expense with no allowance for condensate return to the boiler. Annual cost for steam excluding the cost of gas fuel is $105,000.

Repairs and Maintenance

Annual costs of repairs and maintenance for the building and processing equipment were estimated to be $10,302.55 or approximately 5 percent of the total annual depreciation figure of $206,961.

PROCESSING COSTS

Salt-Cured Hides

The material flow sequence from salt-cured hide to crust leather for the model tannery is given below. 8/

Hide receiving and storage department: This department receives, sorts, and, when necessary, stores salt-cured hides.

Beamhouse department: Hides are soaked to restore moisture, washed to remove excess salt, dirt and blood, fleshed to remove excess flesh and fatty material, dehaired, bated and pickled or prepared to accept tanning material or materials, and tanned or converted into leather. Excess moisture is removed through wringing or other methods, and hides are sided (split into two side pieces).

Blue sort department: This department grades and sorts sides as to quality by measuring weight (thickness) and surface area.

8/Developed from material in "Leather Facts", published by New England Tanner's Club, P.O. Box 371, Peabody, Mass., 01960, 4th Printing, 1972, 41 pp.

Split and shave department: In this department, sides are split or cut to desired thickness and the flesh side is shaved by sanding to obtain a smooth and even surface.

Retan, color, and fat-liquor department: Sides are retanned to add properties of more than one tanning agent to the side, colored with the selected dyeing material, and fat-liquored to lubricate the fibers in the leather.

Setout and pasting department: Setout and wringing smoothes the wrinkles and wrings excess moisture from sides. Sides are then dried on pasting equipment. To condition, specific amounts of moisture are added after drying to make hides pliable.

Staking department: Staking stretches and softens the leather mechanically. Each piece is then buffed or sanded to minimize blemishes.

Crust sort department: Sides are sorted by grade characteristics and defects, trimmed of major defects, measured, and surface area for each side is recorded.

Crust storage, packaging, and shipping department: Crust leather is packed and stored or shipped directly to the customer.

Table 6 presents the estimated total annual operating costs for a model tannery processing 375,000 hides per year, based on the preceding material flow sequence.

Individual expense items were generally allocated to the various operating departments on the basis of the estimated degree of use by the department as related to the total annual plant figure. For example, building depreciation was apportioned according to the department's share of the total square footage of space in the building. Equipment depreciation was based on the department's total equipment value less an estimated salvage value spread over the estimated useful life of the equipment.

The beamhouse department and the retan, color, and fat-liquor department together accounted for 71.0 percent of the total annual operating costs for this model operation. The setout and pasting department accounted for an additional 9.9 percent and the split and shave department, 5.5 percent. The remaining 13.6 percent of the total was accounted for by the five other departments with individual percentages ranging from 2.0 to 3.8 percent of the total annual cost.

Table 7 presents cost per hide, per side, and per square foot for the individual departments. For leather yield, each side of crust leather was assumed to measure 22 square feet of finished material.

Table 6--Estimated annual operating costs for tanning salt-cured cattle hides for model tannery processing 375,000 hides per year by departments, 1973

Item	Hide receiving and storage	Beamhouse	Blue sort	Split and shave	Retan, color and fat-liquor	Setout and pasting	Staking	Crust sort	Storage, packaging, shipping	Total	Percent of total
					Dollars						
Depreciation											
Bldgs. 1/	2,800.00	7,000.00	700.00	1,400.00	7,000.00	4,200.00	1,400.00	700.00	2,800.00	28,000.00	0.6
Equipment	2,583.00	87,676.00	3,782.00	22,260.00	21,735.00	22,020.00	13,565.00	3,215.00	2,125.00	178,961.00	3.9
Labor	50,900.00	267,600.00	61,100.00	115,800.00	82,000.00	218,100.00	83,500.00	82,700.00	40,700.00	1,002,400.00	22.0
Property taxes 1/	6,778.45	16,946.13	1,694.61	3,389.23	16,946.12	10,167.68	3,389.23	1,694.61	6,778.45	67,784.51	1.5
Interest expense											
Bldg. 1/	5,558.90	13,897.24	1,389.72	2,779.45	13,897.24	8,338.34	2,779.45	1,389.72	5,558.90	55,588.96	1.2
Equip. 2/	782.52	44,429.83	1,478.10	11,303.09	11,129.20	9,824.99	5,912.39	1,391.15	695.57	86,946.84	1.9
Insurance 1/	910.92	2,277.31	227.73	455.46	2,277.30	1,366.38	455.46	227.73	910.92	9,109.21	.2
Electricity 2/	628.16	35,665.25	1,186.52	9,073.35	8,933.76	7,886.84	4,746.06	1,116.72	558.36	69,795.00	1.5
Water and sewage 3/		48,053.14			19,627.34	4/	4/			67,680.48	1.5
Fuel (gas)		8,662.50			43,837.50					52,500.00	1.2
Power (steam)		17,325.00			87,675.00					105,000.00	2.3
Repairs & maint. 1/	1,030.26	2,575.64	257.56	515.13	2,575.64	1,545.38	515.13	257.56	1,030.26	10,302.55	.2
Chemicals		360,937.50			931,875.00	19,687.50				1,312,500.00	28.7
Subtotal	71,972.19	913,045.54	71,816.24	166,975.71	1,249,509.10	303,137.11	116,262.72	92,692.48	61,157.46	3,046,568.55	--
Admin. overhead 5/	35,986.10	456,522.77	35,908.12	83,487.86	624,754.55	151,568.56	58,131.36	46,346.24	30,578.73	1,523,284.28	33.3
Total	107,958.29	1,369,568.31	107,724.36	250,463.57	1,874,263.65	454,705.67	174,394.08	139,038.72	91,736.19	4,569,852.83	100.0
Percent of total	2.4	30.0	2.4	5.5	41.0	9.9	3.8	3.0	2.0	100.0	

Individual figures may not add to totals because of rounding.

1/Allocated on basis of square feet of floor space in the department to total square feet in building. 2/Allocated on basis of value of equipment in the department to total value of plant equipment. 3/Based on beamhouse using 71 percent of total water consumed in processing operations and balance allocated to the retan, color, and fat-liquor department. 4/Included in retan, color, and fat-liquor department total. 5/50 percent of subtotal (includes laboratory expenses).

Table 7--Estimated department operating costs for model tannery processing 375,000 salt-cured hides annually, 1973

Department	Cost per hide	Cost per side	Cost for square foot of crust leather 1/
	-----Dollars-----		Cents
Hide receiving and storage	0.290	0.145	0.7
Beamhouse	3.650	1.825	8.3
Blue sort	.290	.145	.7
Split and shave	.670	.335	1.5
Retan, color, and fat-liquor	5.000	2.500	11.4
Setout and pasting	1.210	.605	2.7
Staking	.470	.235	1.0
Crust sort	.370	.185	.8
Crust storage, packing, and shipping	.240	.120	.6
Total	12.190	6.095	27.7

1/Based on estimated yield of 22 square feet per side.

Fresh Hides

The sequence for processing fresh hide to crust leather is slightly different than the procedure for processing salt-cured hide to crust leather. The most significant difference occurs in the beamhouse department. Based on the test procedures discussed in the Poats-Naghski report 9/, fresh hides require less processing time, particularly in the beamhouse processing sequence, than salt-cured hides. It takes 61 hours to process a salt-cured hide through the beamhouse operation (table 8). For a fresh hide, processing takes 52 hours--9 hours less.

Table 8--Time required to process salt-cured and fresh hides through the beamhouse operation

Operation	Salt-cured hide	Fresh hide
	Hours	
Soak	6.0	1.0
Wash	.5	.5
Soak	4.0	.0
Burn and lime	5.5	5.5
Wash	1.0	1.0
Relime	20.0	20.0
Total dehairing time	37.0	28.0
Bate, pickle, and tan	24.0	24.0
Total beamhouse time	61.0	52.0

9/See references cited in footnote 2.

Hide Processor Function (Alternative I Cost Estimation)

Although the model tannery cost estimation procedure was not directed to hide processors, the data presented in tables 6, 7, and 8 can also be used to obtain a major part of the model costs a hide processor would have to consider in deciding whether to add a beamhouse function to his operation. After fresh hides are received from the kill floor, the hide processor washes, demanures, fleshes, trims, and classes them before they go to vats or pits for salt-curing.

Assuming a daily volume of 1,500 hides, a beamhouse operation's variable costs to produce blue, chrome-tanned leather instead of salt-cured hides would entail beamhouse and blue sort operating costs estimated in tables 6 and 7 as well as fresh hide operating times shown in table 8. Facility investment costs for the same operating capacity are shown in table 3 (beamhouse department). Wage costs for beaming are in table 4. Other cost estimates for the hide processing facility (such as overhead, pollution control, and preparation of blue-chrome for sale to customers--i.e. shipping department activities) would have to be added from other sources to complete the cost estimating procedure.

Economic Effects of Shifting From Salt-Cured to Fresh Hide Processing

The 9-hour time savings in beamhouse processing time per hide (table 8) represents a 14.8-percent time savings. Table 7 shows a derived cost of $3.65 for processing a salt-cured hide through the beaming department. This amounts to $0.06 per operating hour per hide in this department. ($3.65 ÷ 61 = $0.0598 or $0.06). Applying this same hourly cost to the time required to process a fresh hide through the beaming operation provides a department operating cost of $3.12 per fresh hide, $0.53 less than for a salt-cured hide.

The 14.8-percent savings in drum operating time in beamhouse operations with fresh hides would affect beamhouse functions and costs in one of two ways: (1) It would allow the model tannery to increase the flow of hides through the beaming department and to beam and chrome-tan an additional 55,000 hides annually, which could be sold as blue-chrome stock to outside buyers. However, this could require some increase in receiving and storing facilities or personnel. Or (2), it would provide for beaming and chrome-tannage of the same number of hides (375,000 annually) at a reduced labor and equipment cost per hide. As stated earlier, this would offer a cost advantage of $0.53 per hide compared with salt-cured hide beaming.

Fresh hide processing offers cost advantages in areas other than beamhouse operations. The recent 300-hide commercial test indicates the crust leather yield per side of fresh hide processed averages 3 percent greater than the crust leather yield of a salt-cured hide. 10/ Assuming a salt-cured side supplies an average of 22 square feet of crust leather, the 3-percent average increase in yield for a fresh hide would amount to an increase in yield of 0.66 square foot per side or 1.32 square feet per hide when salt cure is omitted. The yield increase per side amounts to an effective reduction in tannage costs of $0.05 per square foot or $0.22 per salt-cured hide equivalent. (According to the tanning industry, the number of pieces or "sides" is a better basis of cost

10/See reference cited in footnote 3.

comparison than weight or leather footage in a given lot of hides, since tanning costs are more affected by the number of pieces than by small variations in leather yield per side.) Fresh hide processing could be expected, by increasing yield per side, to lower the overall tanning cost per square foot. Table 7 shows that the cost per side for all tanning operations, excluding the beaming and hide-receiving operations, totals $4.125 ($6.095 less $0.145, less $1.825). Total cost savings could average as much as $0.75 per hide ($0.53 in the beamhouse operation and $0.22 from yield increases).

Total sales revenue also would be affected by the shift from salt-cured to fresh hides. For example, if crust leather was marketed at $1 per square foot, the total sales revenue from a salt-cured hide averaging 44 square feet of crust leather would be $44. When equivalent fresh hide is used the yield of crust leather would be increased by 3 percent without an increase in processing costs. Thus, gross revenue would rise to $45.32 for 45.3 square feet or an increased return of $1.32 per hide. On the basis of 1500 hides per day, this would add $1,980 per day to income for the model operation from a shift to fresh hide as a raw material input. Therefore, using fresh instead of salt-cured hides would result in cost savings and increased revenue totaling $2.07 per hide.

Effect on Pollution Control Costs

The cost savings accruing to the tanner when he shifts from the processing of salt-cured hides to fresh hides will help to offset additional costs required to meet future pollution control standards. Eliminating salt from the tannery effluent resolves a major part of the tannery's long-range pollution problem.

In the model, the shift would have a significant economic impact on pollution control costs. For example, the Stanley Report estimated annual costs of $518,000 for a 3,000 side-upper tannery installing an activated sludge treatment control operation. 11/ This figure, adjusted to an estimated 1973 value by using the 25.1-percent increase between August 1971 and the annual average figure reported for the BLS Wholesale Price Index series entitled Hides, Leather and Related Products Index, amounted to an estimated $747,187 for pollution control. Based on an annual processing of 375,000 salt-cured hides, pollution control would add $1.99 per hide to the processing cost. On a fresh hide basis, adjusted for increased operating volume (55,000 additional fresh hides), pollution control would add an estimated $1.74 per hide. In terms of input, these costs would amount to $0.04 per pound for salt-cured hide and $0.029 per pound for fresh hide.

As stated earlier, the cost savings for fresh over salt-cured hide for the model plant is estimated at $0.22 per hide due to an increased material yield and $0.53 per hide resulting from the savings in drum operating time for a total of $0.75 per hide. Savings per pound of fresh hide amounts to $0.013. Thus, in this instance, 43 percent of the annual pollution control costs would be recovered through in-plant savings in operating costs by shifting from salt-cured to fresh hide as input material.

11/U.S. Environmental Protection Agency, Development Document for Effluent Limitation Guideline and Standards of Performance - Draft, Prepared by Stanley Consultants, Inc., June 1973, p. 102.

CONCLUSIONS

Side-upper leather tanners can obtain significant in-plant cost savings by shifting from the use of salt-cured to fresh hides as input material in their tanning operations. First, in-plant cost savings are estimated to be $0.75 per hide for processing fresh instead of salt-cured hides. Second, this in-plant savings, when applied to estimated annual pollution control costs, can offset a significant portion of this cost. In this study, it amounted to 43 percent of the total pollution costs.

While a shift from salt-cured to fresh hide processing offers significant advantages to U.S. tanneries, it would probably have major effects on hide processors, hide dealers, and brokers who supply tanners with salt-cured hides. Since about half of the annual production of cattle hides is exported as salt-cured hides, a significant market for them would continue to exist unless there were major shifts in foreign markets from salt-cured hides to tanned or semi-finished leather.

Adjustments by the U.S. cattle hide processing industry to meet its water pollution problems will require more research in the future. Some questions that need to be studied are:

(1) How much does the elimination of salt-curing help in solving the total pollution problems of the industry?

(2) Will chrome-tanned hides in blue and crust leather be as marketable as salt-cured hides?

(3) How can hide-curing facilities near sources of fresh hides convert to handle beamhouse functions?

(4) What does the tannery gain or lose when the beamhouse function is no longer physically integrated with further tannage operations?

(5) How will foreign markets for U.S. cattle hides be affected by a change to intermediate leather products?

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